CLAIMS

What is claimed as new and useful is:

1. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, at least one of said two fibers having a non-round cross-section and a Single Fiber Bulk Factor greater than 4.0 and said bundle having

(A) a Specific Volume greater than 4.0 cc/gm,

(B) a MPF_B/MPF_{SF} greater than or equal to 3.0,

(C) a MPF_B greater than or equal to 0.14 cc/(den*hr).

2. The bundle of synthetic fibers of claim 1 having an average inter-fiber capillary width of from 25 to 400 microns.

3. The bundle of synthetic fibers of claim 2 wherein the average inter-fiber capillary width is from 60 to 300 microns.

4. The bundle of synthetic fibers of claim 3 wherein the average inter-fiber capillary width is from 100 to 300 microns.

5. The bundle of synthetic fibers of claim 1 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

6. The bundle of synthetic fibers of claim 1 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.

7. The bundle of synthetic fibers of claim 1 wherein said cross-section of said fiber defines a first arm having a length greater than 40 microns.

8. The bundle of synthetic fibers of claim 7 wherein said first arm has a length greater than 100 microns.

9. The bundle of synthetic fibers of claim 1 wherein said Single Fiber Bulk Factor is between 4.0 and 10.0.

10. The bundle of synthetic fibers of claim 1 wherein said Specific Volume is between 4.0 and 10.0.

11. The bundle of synthetic fibers of claim 10 wherein said Specific Volume is between 4.0 and 7.2.

12. The bundle of synthetic fibers of claim 1 wherein said ratio of said MPF_B/MPF_{SF} is greater than 5.

13. The bundle of synthetic fibers of claim 12 wherein said ratio of said MPF_B/MPF_{SF} is greater than 11.

14. The bundle of synthetic fibers of claim 1 wherein said ratio of said MPF_B/MPF_{SF} is between 3 and about 28.

15. The bundle of synthetic fibers of claim 1 wherein said MPF_B is between 0.14 and 2.00 cc/(den*hr).

16. The bundle of synthetic fibers of claim 15 wherein said MPF_B is between 0.20 and 2.00 cc/(den*hr).

17. The bundle of synthetic fibers of claim 1 wherein said MPF_B is greater than 0.20 cc/(den*hr).

18. The bundle of synthetic fibers of claim 1 wherein said fibers each have a denier between 15 and 250.

19. The bundle of synthetic fibers of claim 18 wherein said fibers each have a denier between 30 and 170.

20. The bundle of synthetic fibers of claim 1 wherein said synthetic fibers comprise a polymeric material selected from the group consisting of polyester, polypropylene, nylon and cellulose esters.

21. The bundle of synthetic fibers of claim 20 wherein the polyester is a poly(ethylene terephthalate) having an inherent viscosity of between 0.6 to 0.9 measured in a 60/40 parts by weight solution of phenol/tetrachloroethane at 25°C and at a concentration of about 0.5 gram of polymer in 100 mL of the solvent.

22. The bundle of synthetic fibers of claim 20 wherein the polypropylene has a melt flow rate of between 15 to 25.

23. An absorbent article having a major axis, a minor axis and a length in excess of a width and said article comprises a top sheet, a back sheet and an absorbent core; said absorbent core comprises at least one

absorbent layer; and with the improvement of said article comprising a bundle of synthetic fibers of claim 1 between said top sheet and said back sheet.

24. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, at least one of said two fibers having a non-round cross-section and said bundle having

(A) a specific volume greater than 4.0 cc/gm,

(B) a MPF_B/MPF_{SF} greater than or equal to 3.0,

(C) a MPF_B greater than or equal to 0.14 cc/(den*hr).

25. The bundle of synthetic fibers of claim 24 having an average inter-fiber capillary width of from 25 to 400 microns.

26. The bundle of synthetic fibers of claim 24 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

27. The bundle of synthetic fibers of claim 24 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene

glycol (600) monolaurate, and 1.8 weight percent 4—cetyl, 4—ethyl morpholinium ethosulfate.

28. The bundle of synthetic fibers of claim 24 wherein said cross—section of said fiber defines a first arm having a length greater than 40 microns.

29. The bundle of synthetic fibers of claim 28 wherein said first arm has a length greater than 100 microns.

30. The bundle of synthetic fibers of claim 24 wherein the Specific Volume is between 4.0 and 10.0.

31. The bundle of synthetic fibers of claim 30 wherein the Specific Volume is between 4.0 and 7.2.

32. The bundle of synthetic fibers of claim 24 wherein said ratio of said MPF_B/MPF_{SF} is greater than 5.0.

33. The bundle of synthetic fibers of claim 32 wherein said ratio of said MPF_B/MPF_{SF} is greater than 11.0.

34. The bundle of synthetic fibers of claim 24 wherein said ratio of said MPF_B divided by said MPF_{SF} is between 3 and about 28.

35. The bundle of synthetic fibers of claim 24 wherein said MPF_B is between 0.14 and 2.00 cc/(den*hr).

36. The bundle of synthetic fibers of claim 35 wherein said MPF_B is between 0.20 and 2.00 cc/(den*hr).

37. The bundle of synthetic fibers of claim 24 wherein said MPF_B is greater than 0.20 cc/(den*hr).

38. The bundle of synthetic fibers of claim 24 wherein the fibers have a denier between 15 and 250.

39. The bundle of synthetic fibers of claim 38 wherein the fibers have a denier between 30 and 170.

40. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, at least one of said two fibers having a non-round cross-section and said bundle having

(A) a MPF_B/MPF_{SF} greater than or equal to 3.0,

(B) a MPF_B greater than or equal to 0.14 cc/(den*hr).

41. The bundle of synthetic fibers of claim 40 having an average inter-fiber capillary width of from 25 to 400 microns.

42. The bundle of synthetic fibers of claim 40 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

43. The bundle of synthetic fibers of claim 40 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol

(400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4—cetyl, 4—ethyl morpholinium ethosulfate.

44. The bundle of synthetic fibers of claim 40 wherein said cross—section of said fiber defines a first arm having a length greater than 40 microns.

45. The bundle of synthetic fibers of claim 44 wherein said first arm has a length greater than 100 microns.

46. The bundle of synthetic fibers of claim 40 wherein said ratio of said MPF_B/MPF_{SF} is greater than 5.0.

47. The bundle of synthetic fibers of claim 46 wherein said ratio of said MPF_B/MPF_{SF} is greater than 11.0.

48. The bundle of synthetic fibers of claim 40 wherein said ratio of said MPF_B/MPF_{SF} is between 3 and about 28.

49. The bundle of synthetic fibers of claim 40 wherein said MPF_B is between 0.14 and 2.00 cc/(den*hr).

50. The bundle of synthetic fibers of claim 49 wherein said MPF_B is between 0.20 and 2.00 cc/(den*hr).

51. The bundle of synthetic fibers of claim 40 wherein said MPF_B is greater than 0.20 cc/(den*hr).

52. The bundle of synthetic fibers of claim 40 wherein the fibers have a denier between 15 and 250.

53. The bundle of synthetic fibers of claim 52 wherein the fibers have a denier between 30 and 170.

54. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, at least one of said two fibers having a non-round cross-section and said bundle having

(A) a Specific Volume greater than 4.0 cc/gm,

(B) a VR_B/VR_{SF} greater than or equal to 1.3, and

(C) a VR_B greater than or equal to 4.0 centimeters.

55. The bundle of synthetic fibers of claim 54 having an average inter-fiber capillary width of from 25 to 400 microns.

56. The bundle of synthetic fibers of claim 54 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

57. The bundle of synthetic fibers of claim 54 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.

58. The bundle of synthetic fibers of claim 54 wherein said cross-section of said fiber defines a first arm having a length greater than 40 microns.

59. The bundle of synthetic fibers of claim 58 wherein said first arm has a length greater than 100 microns.

60. The bundle of synthetic fibers of claim 54 wherein said fibers have a Single Fiber Bulk Factor of greater than 4.0.

61. The bundle of synthetic fibers of claim 60 wherein the Specific Volume is between 4.0 and 10.0.

62. The bundle of synthetic fibers of claim 61 wherein the Specific Volume is between 4.0 and 7.2.

63. The bundle of synthetic fibers of claim 54 wherein VR_B/VR_{SF} is greater than 2.0.

64. The bundle of synthetic fibers of claim 63 wherein VR_B/VR_{SF} is about 2.3.

65. The bundle of synthetic fibers of claim 54 wherein VR_B/VR_{SF} is between 1.66 and 11.7.

66. The bundle of synthetic fibers of claim 54 wherein VR_B is between 4.0 and 15 centimeters.

67. The bundle of synthetic fibers of claim 54 wherein the fibers have a denier between 15 and 250.

68. The bundle of synthetic fibers of claim 67 wherein the fibers have a denier between 30 and 170.

69. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, at least one of said two fibers having a non-round cross-section and a VR_{SF} less than or equal to 4.0 centimeters and said bundle having a Specific Volume greater than 4.0 cc/gm and a VR_B/VR_{SF} greater than or equal to 1.3.

70. The bundle of synthetic fibers of claim 69 having an average inter-fiber capillary width of from 25 to 400 microns.

71. The bundle of synthetic fibers of claim 69 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

72. The bundle of synthetic fibers of claim 69 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.

73. The bundle of synthetic fibers of claim 69 wherein said cross-section of said fiber defines a first arm having a length greater than 40 microns.

74. The bundle of synthetic fibers of claim 73 wherein said first arm has a length greater than 100 microns.

75. The bundle of synthetic fibers of claim 69 wherein said fibers have a Single Fiber Bulk Factor of greater than 4.0.

76. The bundle of synthetic fibers of claim 75 wherein the Specific Volume is between 4.0 and 10.0.

77. The bundle of synthetic fibers of claim 76 wherein the Specific Volume is between 4.0 and 7.2.

78. The bundle of synthetic fibers of claim 69 wherein VR_B/VR_{SF} is greater than 2.0.

79. The bundle of synthetic fibers of claim 78 herein VR_B/VR_{SF} is about 2.3.

80. The bundle of synthetic fibers of claim 69 wherein VR_B/VR_{SF} is between 1.66 and 11.7.

81. The bundle of synthetic fibers of claim 69 wherein the fibers have a denier between 15 and 250.

82. The bundle of synthetic fibers of claim 74 wherein the fibers have a denier between 30 and 170.

83. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, at least one of said two fibers having

(A) a non-round cross-section;
(B) a Single Fiber Bulk Factor greater than 4.0;
(C) (i) a Specific Capillary Volume less than 2.0 cc/gm or a Specific Capillary Surface Area less than 2000 cc/gm, and (ii) more than 70% of intra-fiber channels having a capillary channel width greater than 300 microns; and
(D) an adhesion tension of distilled water on the surface greater than 25 dynes/cm.

84. The bundle of synthetic fibers of claim 83 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

85. The bundle of synthetic fibers of claim 84 wherein the $P\gamma \cos(\theta a))/d$ is between 0.03 and 0.10 dynes/den.

86. The bundle of synthetic fibers of claim 85 wherein the $P\gamma \cos(\theta a))/d$ is between 0.04 and 0.073 dynes/den.

87. The bundle of synthetic fibers of claim 83 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene

glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.

88. The bundle of synthetic fibers of claim 83 having an average inter-fiber capillary width of from 25 to 400 microns.

89. The bundle of synthetic fibers of claim 83 wherein said cross-section of said fiber defines a first arm having a length greater than 40 microns.

90. The bundle of synthetic fibers of claim 89 wherein said first arm has a length greater than 100 microns.

91. The bundle of synthetic fibers of claim 83 wherein the Single Fiber Bulk Factor is between 4.0 and 10.0.

92. The bundle of synthetic fibers of claim 83 wherein the Specific Capillary Volume is between 0.0 and 1.5 cc.

93. The bundle of synthetic fibers of claim 92 wherein the Specific Capillary Volume is between 0.0 and 1.0 cc.

94. The bundle of synthetic fibers of claim 84 wherein the Specific Capillary Surface Area is less than 1500 cm^2/gm.

95. The bundle of synthetic fibers of claim 83 wherein the fibers have a denier between 15 and 250.

96. The bundle of synthetic fibers of claim 95 wherein the fibers have a denier between 30 and 170.

97. A bundle of synthetic fibers for transporting non-polar fluids comprising at least two fibers in a bundle, at least one of said two fiber having

(A) a non-round cross-section;

(B) a Single Fiber Bulk Factor greater than 4.0;

(C) (i) a Specific Capillary Volume less than 2.0 cc/gm or a Specific Capillary Surface Area less than 2000 cc/gm, and

(ii) more than 70% of intra-fiber capillaries having a channel width greater than 300 microns; and

(D) a hydrophobic surface composition.

98. The bundle of synthetic fibers of claim 97 having an average inter-fiber capillary width of from 25 to 400 microns.

99. The bundle of synthetic fibers of claim 97 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

100. The bundle of synthetic fibers of claim 97 wherein said cross-section of said fiber defines a first arm having a length greater than 40 microns.

101. The bundle of synthetic fibers of claim 100 wherein said first arm has a length greater than 100 microns.

102. The bundle of synthetic fibers of claim 97 wherein said Single Fiber Bulk Factor is between 4.0 and 10.0.

103. The bundle of synthetic fibers of claim 97 wherein said Specific Capillary Volume is between 0.0 and 1.5 cc.

104. The bundle of synthetic fibers of claim 103 wherein said Specific Capillary Volume is between 0.0 and 1.0 cc.

105. The bundle of synthetic fibers of claim 97 wherein said Specific Capillary Surface Area is less than 1500 cc/gm.

106. The bundle of synthetic fibers of claim 97 wherein said fibers each have a denier between 15 and 250.

107. The bundle of synthetic fibers of claim 106 wherein said fibers each have a denier between 30 and 170.

108. A bundle of synthetic fibers for transporting aqueous fluids comprising at least two fibers in a bundle, wherein

(1) at least one of said two fibers has
    (A) a non-round cross-section defined by a first arm having a length greater than 40 microns and a second arm having a length greater than 40 microns and
    (B) a Single Fiber Bulk Factor greater than 4.0, and

(2) said bundle has
    (A) a Specific Volume greater than 4.0 cc/gm,
    (B) a MPF_B/MPF_{SF} greater than or equal to 3.0,

(C) a MPF_B greater than or equal to 0.14 cc/(den*hr).

109. The bundle of synthetic fibers of claim 108 wherein the cross-section and the surface composition of the fibers satisfy the inequality: $(P\gamma \cos(\theta a))/d > 0.03$ dynes/den,

wherein P is the perimeter of the cross-section of the fiber, γ is the surface tension of the liquid, (θa) is the advancing contact angle of the liquid measured on a flat surface made from the same material as the fiber and having the same surface treatment and d is the denier of the fiber.

110. The bundle of synthetic fibers of claim 108 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.

111. The bundle of synthetic fibers of claim 108 wherein said cross-section of said fiber further defines a third arm having a length greater than 40 microns.

112. The bundle of synthetic fibers of claim 111 wherein said first arm, said second arm and said third arm all radiate from a common axis.

113. The bundle of synthetic fibers of claim 112 wherein said first arm and said second arm define a first angle having a vertex at said common axis,

said second arm and said third arm define a second angle having a vertex at said common axis,

said third arm and said first arm define a third angle having a vertex at said common axis, and

said first angle, said second angle, and said third angle are all substantially 120°.

114. The bundle of synthetic fibers of claim 113 wherein said first arm has a first distal tip, said second arm has a second distal tip, said third arm has a third distal tip, and the distal tips of adjacent ones of the first, second, and third arms are separated by between about 330 and about 390 microns.

115. The bundle of synthetic fibers of claim 112 wherein

said first arm and said second arm define a first angle having a vertex at said common axis,

said second arm and said third arm define a second angle having a vertex at said common axis,

said third arm and said first arm define a third angle having a vertex at said common axis, and

said first angle and said second angle are substantially 90° and said third angle is substantially 180°.

116. The bundle of synthetic fibers of claim 115 wherein said first arm has a first distal tip, said second arm has a second distal tip, said third arm has a third distal tip, and the distal tips of said first arm and said second arm are separated by greater than 200 microns.

117. The bundle of synthetic fibers of claim 111 wherein said cross-section of said fiber further defines a fourth arm having a length greater than 40 microns.

118. The bundle of synthetic fibers of claim 117 wherein said first arm, said second arm, said third arm and said fourth arm all radiate from a common axis.

119. The bundle of synthetic fibers of claim 118 wherein said first arm has a first distal tip, said second arm has a second distal tip, said third arm has a third distal tip, said fourth arm has a fourth distal tip and said first distal tip is separated from said second distal tip by at least about 125 microns.

120. The bundle of synthetic fibers of claim 119 wherein said second arm is adjacent said third arm, and said second distal tip of said second arm is separate from said third distal tip of said third arm by at least about 333 microns.

121. The bundle of synthetic fibers of claim 1 wherein said cross-section of said fiber defines a substantially semi-circular shape having a center region, a first end region including a first distal tip, and a second end region including a second distal tip; and said first distal tip is separated from said second distal tip by greater than 200 microns.

122. The bundle of synthetic fibers of claim 121 wherein said first distal tip is separated from said second distal tip by greater than 400 microns.

123. The bundle of synthetic fibers of claim 1 wherein said cross-section of said fiber defines

(a) a first arm extending from a first proximal end to a first distal tip and having a length greater than 40 microns,

(b) a second arm extending from a second proximal end to a second distal tip and having a length greater than 40 microns,

(c) a third arm extending from a third proximal end to a third distal tip and having a length greater than 40 microns,

(d) a fourth arm extending from a fourth proximal end to a fourth distal tip and having a length greater than 40 microns,

(e) a base extending from a first base end to a second base end and having a length greater than 200 microns,

wherein said first proximal end and said second proximal end join said first base end and said third proximal end and said fourth proximal end join said second base end, thereby forming a general "I" shape.

124. The bundle of synthetic fibers of claim 123 wherein said first distal tip is separated from said third distal tip and said fourth distal tip by at least 200 microns.

125. A process of making a bundle of synthetic fibers, the process comprising the steps of

(A) extruding molten polymer from a shaped aperture of a spinnerette to form an extruded synthetic fiber, the aperture having a non-round cross-section and

(B) quenching and lubricating the extruded synthetic fiber, the synthetic fiber having a non-round cross-section and a Single Fiber Bulk Factor greater than 4.0 and the bundle having a Specific Volume greater than 4.0 cc/gm, a MPF_B/MPF_{SF} greater than or equal to 3.0, and a MPF_B greater than or equal to 0.14 cc/(den*hr).

126. The process of claim 125 further comprising heating the polymer to a temperature between about 270° and about 300° centigrade during the step of extrusion and wherein the polymer is polyethylene terephthalate.

127. The process of claim 125 wherein the step of extruding is from the aperture having a width of less than 0.12 millimeters.

128. The process of claim 127 wherein the step of extruding is from the aperture having a width of the less than 0.090 millimeters.

129. The process of claim 127 wherein the step of extruding is from the aperture having a length of an arm of the aperture greater than 50 times the width.

130. The process of claim 129 wherein the step of extruding is from the aperture having a length of the arm greater than 100 times the width.

131. The process of claim 129 wherein the step of extruding is from the aperture having at least three arms.

132. A spinnerette for extruding a shaped fiber, said spinnerette having surfaces defining at least one shaped aperture, said shaped aperture having:

(1) a first arm having a first width and a first length,

(2) a second arm having a second width and a second length, and

(3) a third arm having a third width and a third length,

wherein

(4) said first arm, said second arm, and said third arm all radiate from a common axis,

(5) said first width is less than 0.12 millimeters and

(6) said first length is greater than about forty times said first width.

133. The spinnerette of claim 132 wherein said first length is greater than about sixty times said first width.

134. The spinnerette of claim 132 wherein said second length is greater than about seventy times said first width.

135. The spinnerette of claim 132 wherein said first length is greater than about seventy times said first width and said second length is greater than about fifteen times said first width.

136. The spinnerette of claim 135 wherein said third length is greater than about seventy times said first width.

137. The spinnerette of claim 132 wherein

(1) said first length is greater than about seventy times said first width,

(2) said second length is greater than about seventy times said first width,

(3) said third length is greater than about seventy times said first width,

(4) said first length, said second length, and said third length are all equal.

138. The spinnerette of claim 137 wherein said first length, said second length, and said third length are symmetric about said common axis.

139. The spinnerette of claim 132 wherein

(1) said first length is greater than about seventy times said first width,

(2) said second length is greater than about seventy times said first width,

(3) said third length is greater than about seventy times said first width,

(4) said first arm and said second arm define an angle of less than 180°, and said third arm is in the angle defined by the first arm and the second arm.

140. The spinnerette of claim 132 wherein said shaped aperture further has a fourth arm and said fourth arm has a fourth length and a fourth width, said fourth length being greater than about ten times said fourth width.

141. The spinnerette of claim 132 wherein said first width, said second width, and said third width are equal.

142. A spinnerette for extruding a shaped fiber, said spinnerette having surfaces defining at least one shaped aperture, said shaped aperture having a substantially semicircular portion having a radius and a width wherein said width is less than 0.12 millimeters and said radius is more than about fifty times said width.

143. The spinnerette of claim 142 wherein said radius is more than 100 times said width.

144. The spinnerette of claim 142 wherein said shaped aperture includes protrusions from said semicircular portion having a protrusion length of no more than about five times said width.

145. A liquid acquisition/distribution structure comprising:

(1) a top layer that is permeable to a liquid,

(2) a distribution layer comprising a capillary system providing capillary forces on the liquid when the liquid is in contact with said distribution layer tending to transport the liquid parallel to said top layer, and

(3) a resistance layer having a resistance layer top surface and a resistance layer bottom surface, said resistance layer provides resistance to transmission of the liquid from said resistance layer top surface to said resistance layer bottom surface.

146. An absorbent product comprising the liquid acquisition/distribution structure of claim 145 and further comprising an absorbent core beneath said resistance layer.

147. An absorbent product comprising the liquid acquisition/distribution structure of claim 145 and further comprising an absorbent core partially surrounded by said distribution layer and said resistance layer.

148. The structure of claim 145 wherein said top layer comprises a perforated film, a calendar bonded sheet, or a spun bonded sheet.

149. The structure of claim 145 wherein

(1) said top layer has a top layer upper surface and a top layer lower surface, said top layer lower surface opposing said distribution layer,

(2) said top layer upper surface has a first contact angle with said liquid,

(3) said top layer lower surface has a second contact angle with said liquid, and

(4) said second contact angle is less than said first contact angle.

150. The structure according to claim 145 wherein said capillary system comprises a bundle of fibers arranged so that in a region their axes are parallel to said top layer.

151. The structure according to claim 145 wherein said capillary system comprises a bundle of spontaneously transporting fibers arranged so that in a region their axes are essentially parallel to said top layer.

152. The structure according to claim 145 wherein said capillary system comprises a bundle of fibers of claim 1 arranged so that in a region their axes are essentially parallel to the top layer.

153. The structure according to claim 145 wherein the MPF_B of the fibers in the distribution layer is greater than 0.005 cc/den*hr.

154. The structure according to claim 145 wherein said capillary system comprises a bundle fibers of claim 1 arranged so that in a region their axes are essentially parallel to said top layer.

155. The structure according to claim 145 wherein said resistance layer includes regions of relatively high liquid resistivity and a plurality of spatially distinct regions of relatively low liquid resistivity.

156. The structure according to claim 154 wherein said regions of relatively low liquid resistivity are sized shaped and arranged to distribute liquid substantially uniformly to an absorbent core beneath said resistance layer.

157. The structure of claim 145 wherein said capillary system is designed with capillaries fanning out from a region.

158. The structure of claim 145 wherein said capillary system is designed with capillaries providing a two-dimensional flow pattern.

159. The structure of claim 145 wherein said structure has a major axis and said capillary system comprises a bundle of fibers aligned with said major axis in a band having a width of no more than one inch.

160. The structure of claim 145 wherein said distribution layer weighs between one and ten grams and comprises fibers having lengths between ten and seventy centimeters.

161. The structure of claim 145 wherein said distribution layer weighs between one half and four grams and comprises fibers having lengths between ten and forty centimeters.

162. The structure of claim 145 wherein said distribution layer weighs between one quarter and two grams and comprises fibers having lengths between seven and twenty-five centimeters.

163. The structure of claim 145 wherein said distribution layer comprises fibers of a first length and fibers of a second length that is different from said first length.

164. A liquid acquisition/distribution structure comprising:

(1) a top layer that is permeable to a liquid and having a region intended for insult by a liquid;

(2) a resistance layer having a resistance layer top surface and a resistance layer bottom surface, said resistance layer provides resistance to transmission of said liquid from said resistance layer top surface to said resistance layer bottom surface; and

(3) a distribution layer between the top layer and said resistance layer comprising a capillary system providing capillary forces on the liquid when the liquid is in contact with said distribution layer, said capillary forces tending to transport the liquid substantially parallel to said top surface;

(4) wherein said resistance layer comprises

(a) a first region directly beneath said region intended for insult by said liquid,

(b) a second region that is separated from said first region,

(c) a third region that separates said first region from said second region, and

(d) said first and second regions have a lower resistance to transmission of said liquid from said resistance layer top surface

to said resistance layer bottom surface than said third region.

165. The structure of claim 164 wherein said first region is smaller than said second region.

166. The structure of claim 164 wherein said first region is about 0.5 centimeters in diameter.

167. A synthetic fiber, said synthetic fiber having

(1) an axis,

(2) a cross-section perpendicular to said axis, said cross-section having a cross-sectional shape,

(3) said cross-sectional shape defines a first arm, said first arm has a first arm length greater than 40 microns, said first arm has a first arm width at the midpoint of the first arm, and a first ratio of the first arm length to the first arm width is greater than 10,

(4) said cross-sectional shape defines a second arm, said second arm has a second arm length greater than 40 microns, said second arm has a second arm width at the midpoint of said second arm, and a second ratio of the second arm length to the second arm width is greater than 10,

(5) said cross-sectional shape defines a third arm, said third arm has a length greater than 40 microns, said third arm has a third arm width at the midpoint of said third arm, and

(6) said first arm, said second arm, and said third arm all radiate from a common point.

168. The synthetic fiber of claim 167 wherein

(7) said first arm and said second arm define a first angle having a vertex at said common point,

(8) said second arm and said third arm define a second angle having a vertex at said common point, and

(9) said third arm and said first arm define a third angle having a vertex at said common point, and

(10) said first angle, said second angle, and said third angle are all substantially 120°, said first ratio and said second ratio are each greater than about 20, and a third ratio of said third arm length to said third arm width is greater than about 20.

169. The synthetic fiber of claim 168 wherein said first arm has a first distal tip, said second arm has a second distal tip, said third arm has a third distal tip, and the distal tips of adjacent ones of the first, second, and third arms are separated by between about 330 and about 390 microns.

170. The fiber of claim 167 wherein

(7) said first arm and said second arm define a first angle having a vertex at said common point,

(8) said second arm and said third arm define a second angle having a vertex at said common point, and

(9) said third arm and said first arm define a third angle having a vertex at said common point, and

(10) said first angle and said second angle are less than 120°, and said third angle is greater than 120°.

171. The synthetic fiber of claim 170 wherein

(11) said first angle and said second angle are substantially 90°,

(12) said third angle is substantially 180°, and

(13) said first ratio and said second ratio are greater than about 25.

172. The synthetic fiber of claim 171 wherein each of said first arm, said second arm, and said third arm has a distal tip, and the distal tips of said first arm and said second arm are separated by are greater than 200 microns.

173. The synthetic fiber of claim 167 wherein

(7) said cross-sectional shape defines a fourth arm and said fourth arm has a fourth arm length greater than 40 microns and a fourth arm width at the midpoint of said fourth arm, and

(8) said first arm, said second arm, said third arm, and said fourth arm all radiate away from said common point and said first ratio and said second ratio are each greater than about 20.

174. The synthetic fiber of claim 173 wherein said first arm has a first distal tip, said second arm has a second distal tip, said third arm has a third distal tip, said fourth arm has a fourth distal tip, said first arm is adjacent said second arm, and said first distal tip is separated from said second distal tip by at least about 125 microns.

175. The synthetic fiber of claim 174 wherein said second arm is adjacent said third arm, and said distal tip of said second arm is separated from said distal tip of said third arm by at least about 333 microns.

176. The synthetic fiber of claim 167 wherein said first arm width is between 5 and 20 microns.

177. The synthetic fiber of claim 167 wherein said first arm length and said second arm length are each between 200 and 800 microns.

178. The synthetic fiber of claim 177 wherein said third arm length is greater than 100 microns.

179. The synthetic fiber of claim 167 wherein said synthetic fiber has a surface having an adhesion tension with water of between 20 and 60 dynes per centimeter.

180. The bundle of synthetic fibers of claim 167 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.

181. A synthetic fiber having

(1) an axis,

(2) a cross-section perpendicular to said axis, said cross-section having a cross-sectional shape,

(3) said cross-sectional shape defines a substantially semi-circular shape, said shape having a center region, a first end region including a first distal tip, and a second end region including a second distal tip, a cross-section length from the first distal tip along the cross-section to the second distal tip, and a cross-section width of said cross-section at the center of said shape cross-section,

(4) said first distal tip is separated from said second distal tip by greater than 40 microns, and

(5) a ratio of the cross-section length to the cross-section width is greater than 20.

182. The synthetic fiber of claim 181 wherein said first distal tip is separated from said second distal tip by greater than 400 microns.

183. The synthetic fiber of claim 181 wherein said cross-section width is between 20 and 40 microns.

184. The synthetic fiber of claim 181 wherein said ratio is between 30 and 60.

185. The synthetic fiber of claim 181 wherein said synthetic fiber has an adhesion tension with water of between 20 and 60 dynes per centimeter.

186. The bundle of synthetic fibers of claim 181 wherein said fibers have a lubricant coated thereon comprising 90 weight percent water and 10 weight percent solids component, said solids component comprising 10 weight percent solution of poly[polyethyleneglycol (1400) terephthalate], 44.1 weight percent polyethylene glycol (400) monolaurate, 44.1 weight percent polyethylene glycol (600) monolaurate, and 1.8 weight percent 4-cetyl, 4-ethyl morpholinium ethosulfate.